Principles of Electronic Image Processing - Image Processing Systems
Sherry Miller Hocking

Experimental Television Center, 1978-1980

A video synthesizer or “image processor” is a general term referring to an assemblage of individual video signal sources and processors, all of which are integrated into a single system.

There are three general categories of devices: 1) signal sources devices which output a signal used in the system to generate an image, a control signal or a sync signal. 2) processors devices which perform some operation upon the signals, such as gain or phase changes, and are often used to mix inputs and put out combined or processed signals. 3) controllers-devices which generate signals which are themselves inputs to processing devices to control an aspect of the image. These devices can be analog or digital in nature.

A video source is any device which internally generates a signal that can be displayed, and includes cameras, decks, character generator or oscillator. A processor is a device which either changes the parameter of the incoming signal (e.g. gain, polarity, waveshape) or combines two or more signals and presents them to the output (e.g. mixing, switching, wiping). Video processors include keyers, VCAs, mixers, colorizers, sequencers, SEGs and frame buffers. These terms are not absolute but have meaning relative to one another. A signal can be routed through processors in a linear order.

Signals have direction: that is, they are originated, are passed through devices and eventually wind up at a device which transduces, or changes, the signal into a form of information that is directly meaningful to our senses. In the case of video, the electrical signal is changed into information by the video monitor which our eyes understand as light and ultimately pictures. The video image itself does not travel through the machine, rather it is an electronic signal which represents the image that travels. This signal originates in a video camera or some other type of signal generator such as an oscillator in an analog synthesizer.

The three main types of image processing signals are: 1) video signals - those which contain the complete information necessary for a monitor to construct an image 2) sync signals-those containing structural, rather than picture, information, which when combined with picture information allows it to be stable and rectangular. 3) control signals-those which contain information for the control of processes.

An image processing system is then a collection of devices the structure of which includes: 1) sync, 2) routing, 3) an output amplifier, 4) a method of monitoring, 5) a method of control.

Termination: A commonly used video connection scheme is the looped-through input, sometimes called a bridged input. This set-up facilitates ease in formulating multiple connections while maintaining the ability to “terminate” the video signal. Termination is required at the farthest input. This is usually done by connecting a terminator to the remaining bridged connector. Sometimes a switch is provided on a monitor input for termination, labelled “75 ohms” in one position and “high” in the other. The 75 ohm position is the terminating position.

Genlock: Sometimes it is desirable to take as an input to the image processing system a video signal from a pre-recorded videotape. Since the sync from the source is controlled from the point of origin (the VTR) it is necessary to “lock” the system sync to the sync from the source. A genlock is required for this operation. Genlock is also used for cameras which are not externally syncable. This includes most consumer cameras. The output of the camera goes to the genlock input of the SEG and the system will lock to the internal sync of that

camera. A VTR cannot be used as a direct source once the genlock is occupied by the camera.

Three devices are used to check the signal coming from the output amp: The waveform monitor, the vectorscope, and the color or black and white monitors. These are also used to compare the signal at different points in the path.

The waveform monitor does no processing of the video signal. It allows us to examine the quality of the video signal by giving us a graphic representation of the voltage of the video signal with respect to time. The waveform monitor is really a special purpose oscilloscope. Vertical distance on the waveform display represents voltage, while horizontal represents time. There is a choice of “strobe” times so that one field or line of the video signal can be observed.

Normally, the waveform monitor is set to display two horizontal periods, or two lines of video. What is seen is actually an overlay of many different lines. Within this, you can see the luminance and black level of the signal as well as the stability of the sync. Other settings show the vertical scan period and an enlarged view of color burst.

A vectorscope shows the color portion of the video signal. It uses the convention of a color wheel to represent the signal. Chroma, or saturation, is indicated by how far the signal extends from the center. It should not exceed the outer circumference of the circle of noise which may appear in the recorded signal a few generations later. The hues are marked at specific points initialed M (magenta), R (red), G (green), Y (yellow), B (blue), and C (cyan). The vectorscope has a phase adjustment which places burst at 180 degrees. At this setting when color bars are patched to its input, the signal's six points will correspond to the marks.

There are several types of color monitors. There as the clip input signal to switch between the two main channels. A continuous change in the threshold point, or clip level, from low voltage to high voltage, or vice versa, is often called a wipe.

A colorizer takes as its input a black and white video signal, then adds color in a fashion according to the type of colorizer. Usually a colorizer unit contains other video processing as well, such as negative video, keying, mixing.